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DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

L9289.01143

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/856872

INTERNATIONAL APPLICATION NO.
PCT/JP00/05804INTERNATIONAL FILING DATE
August 29, 2000PRIORITY DATE CLAIMED
September 29, 1999

TITLE OF INVENTION

COMMUNICATION TERMINAL APPARATUS AND RADIO COMMUNICATION METHOD

APPLICANT(S) FOR DO/EO/US

Yoshiko SAITO, Mitsuru UESUGI and Osamu KATO

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Claim for Priority with PCT/IB/304
PCT/IB/308
PCT/RO/101

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/856872

INTERNATIONAL APPLICATION NO.

PCT/JP00/05804

ATTORNEY'S DOCKET NUMBER

L9289.01143

24. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00
- ☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00
- ☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00
- ☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =**CALCULATIONS PTO USE ONLY****\$860.00**Surcharge of **\$130.00** for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).☐ 20 ☐ 30**\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	4 - 20 =	0	x \$18.00
Independent claims	2 - 3 =	0	x \$80.00

\$0.00**\$0.00**

Multiple Dependent Claims (check if applicable).

☐**\$0.00****TOTAL OF ABOVE CALCULATIONS =****\$860.00**

Applicant claims small entity status. (See 37 CFR 1.27). The fees indicated above are reduced by 1/2.

\$0.00**SUBTOTAL =****\$860.00**Processing fee of **\$130.00** for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).☐ 20 ☐ 30

+

\$0.00**TOTAL NATIONAL FEE =****\$860.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).

☒**\$40.00****TOTAL FEES ENCLOSED =****\$900.00**Amount to be:
refunded

\$

charged

\$

- a. ☒ A check in the amount of **\$900.00** to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **19-4375**. A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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28,732

REGISTRATION NUMBER

May 29, 2001

DATE

DESCRIPTION

COMMUNICATION TERMINAL APPARATUS AND RADIO COMMUNICATION
METHOD

5 Technical Field

The present invention relates to a communication terminal apparatus and a radio communication method, both being used for a digital radio communication system.

10 Background Art

Because not only sounds but also data and pictures are transmitted in multimedia movement communication, high-speed and highly reliable transmission is needed. To realize such transmission, interference between codes
15 generated by frequency selective fading should be restrained.

As a method for restraining the frequency selective fading, there is a pre-coding technique. The pre-coding technique is a technique in which a base station performs
20 channel estimation by the use of a received signal on a reverse link to obtain a channel estimated value and the inverse function of the obtained channel estimated value is given to a signal on a forward link and then the signal having the inverse function is transmitted to a
25 communication terminal and thereby the necessity of the correction of the distortion of the signal on the propagation path on the communication terminal side is

ideally obviated.

The pre-coding technique can presume the state of propagation paths of the forward link on the basis of a signal on the reverse link in the case where the same frequency is used for the reverse link and the forward link like the time division duplex (TDD) system, and the pre-coding technique is realized by using a tap coefficient calculated from the signal on the reverse link as it is at the time of the transmission of the signal on the forward link. Moreover, because the hardware can be concentrated on the side of the transmission unit, the technique has an advantage that the hardware configuration on the side of the reception unit can be simplified.

Hereinafter, a conventional pre-coding technique will be described by reference to FIGs. 1 and 2. FIG. 1 is a block diagram showing the configuration of a conventional base station apparatus, and FIG. 2 is a block diagram showing the configuration of a conventional communication terminal apparatus.

The communication terminal apparatus shown in FIG. 2 performs the digital modulation of data to be transmitted in a modulation section 14 and performs the prescribed radio transmission processing of the digitally modulated data to be transmitted to transmit them to a base station apparatus through an antenna 11 as a transmission signal.

The base station apparatus shown in FIG. 1 receives

the signal transmitted from the communication terminal apparatus with a plurality of antennas 1. At this time, the signal is received in the reception directivity formed by a directivity control section 2. The received signal
5 is processed by a prescribed radio reception processing and becomes a baseband signal.

On the other hand, the channel estimation is performed by estimating the impulse response using adaptive algorithm 3. The set tap coefficient is
10 transmitted to a replica generation section 4 and a pre-coder 9.

The replica generation section 4 obtains a candidate wave form (or a replica) by making the data pattern of the signal transmitted from the communication terminal apparatus pass through a filter on an estimated propagation
15 path having the tap coefficient set by the adaptive algorithm 3. The replica is formed about all of the considerable data patterns.

The replica is compared with the data pattern of the
20 signal transmitted from the communication terminal apparatus and the result of the comparison is transmitted to a judgment section 5. The judgment section 5 selects a replica being most approximate to the data pattern, and judges the data pattern corresponding to the replica to
25 be the data pattern of the signal transmitted from the communication terminal apparatus to transmit the data pattern to an error detection section 6. The error

detection section 6 performs the error detection processing of the judged data. Reception data are thereby obtained.

In the base station apparatus, data to be transmitted are transmitted to a frame formation section 8 after the data is digitally modulated in a modulation section 7. In the frame formation section 8, the data to be transmitted are configured into a frame configuration. The data configured to be the frame configuration are transmitted to a pre-coder 9.

In the pre-coder 9, the complex conjugate of the tap coefficient set by the adaptive algorithm 3 is multiplied by the data to be transmitted, and the inverse function of the impulse response on the propagation path is given to the data to be transmitted. Incidentally, at this time, divergence prevention processing such as the modulo-two operation (hereinafter referred to as MOD-2) of the transmitted data may be performed as the need arises.

The data to be transmitted to which the inverse function is given in such a way are transmitted from the antennas 1 in the directivity formed in the directivity control section 2 after a predetermined radio transmission processing of the data to be transmitted has been performed.

The signal transmitted from the base station apparatus is received by the antenna 11 of the communication terminal apparatus, and then the received

signal is processed in conformity with the prescribed radio reception processing to be transmitted to a detection/de-pre-coder 12. The detection/de-pre-coder 12 demodulates the received data in conformity with the orthogonal detection or other demodulation methods. If the divergence prevention processing such as MOD-2 of the received data has been performed as mentioned above in this case, the de-pre-coder 12 presumes the received data.

The received data that has been demodulated in such a way is transmitted to an error detection section 13. The error detection section 13 performs the error detection processing to judged data.

However, in the aforesaid pre-coding technique, as shown in FIG. 3, a propagation environment is estimated on the basis of a signal received in the reception interval (RX) of the base station apparatus, and a tap coefficient obtained as the estimation result is used in the transmission interval (TX) of the base station apparatus. Consequently, because the inverse function of a channel is not updated in the reception interval of the communication terminal apparatus (corresponding to the transmission interval of the base station apparatus), there is a problem that the communication deteriorates in the reception interval of the communication terminal apparatus. The example shown in FIG. 3 is symmetrical communication, but, in case of asymmetrical communication, the pre-coding is performed by the use of a tap coefficient

that has been estimated at earlier time, and the deterioration of communication becomes conspicuous. Because the rate of the asymmetrical communication becomes large in multimedia communication, this problem
5 becomes serious.

Disclosure of Invention

An object of the present invention is to provide a communication terminal apparatus and a radio
10 communication method, both capable of following the changes of a propagation environment and capable of equalizing effectively the distortion that a signal receives in a propagation path.

The subject matter of the present invention is to
15 decrease the load of the operation of the equalization processing in a communication terminal apparatus and to shorten the processing time of the equalization processing by using a tap coefficient set by adaptive algorithm in a base station apparatus as an initial value
20 for omitting the processing up to initial value setting in the adaptive algorithm in the communication terminal apparatus.

Brief Description of Drawings

25 FIG. 1 is a block diagram showing the configuration of a conventional base station apparatus;

FIG. 2 is a block diagram showing the configuration

of a conventional communication terminal apparatus;

FIG. 3 is a timing chart for illustrating pre-coding;

FIG. 4 is a block diagram showing the configuration
of a base station apparatus according to an embodiment
5 of the present invention;

FIG. 5 is a block diagram showing the configuration
of a communication terminal apparatus according to an
embodiment of the present invention; and

FIG. 6 is a graph for illustrating an advantage of
10 the communication terminal apparatus according to the
embodiment of the present invention.

Best Mode for Carrying Out the Invention

Hereinafter, an embodiment of the present invention
15 will be described in detail by reference to the attached
drawings.

FIG. 4 is a block diagram showing the configuration
of a base station apparatus according to an embodiment
of the present invention, and FIG. 5 is a block diagram
20 showing the configuration of a communication terminal
apparatus according to an embodiment of the invention.

The base station apparatus shown in FIG. 4 comprises
a plurality of antennas 101, a directivity control section
102 for controlling the directivity of reception and
25 transmission, a replica generation section 104 for
generating a replica by the use of adaptive algorithm 103
for obtaining a tap coefficient of a filter for an

estimation propagation path, a judgment section 105 for performing the judgment of data to be transmitted by the comparison of a replica with the data to be transmitted, an error detection section 106 for performing the error
5 detection processing of the data after the judgment, a modulation section 107 for performing the digital modulation of the data to be transmitted, and a frame formation section 108 for performing the frame configuration of the modulated data to be transmitted and
10 the tap coefficient set by the adaptive algorithm.

The communication terminal apparatus shown in FIG. 5 comprises an antenna 201, a detection section 202 for demodulating a received signal in conformity with the orthogonal detection or other demodulation methods, an
15 equalization section 203 for performing the equalization processing of the detected received data by means of adaptive algorithm 204, an error detection section 205 for performing the error detection of the equalized received data, and a modulation section 206 for performing
20 the digital modulation of data to be transmitted.

The operation of the base station apparatus and the communication terminal apparatus that have the aforesaid configurations respectively will be described.

The communication terminal apparatus shown in FIG. 5 performs the digital modulation of the data to be
25 transmitted in the modulation section 206 and performs the prescribed radio transmission processing of the

digitally modulated data to be transmitted to transmit them to the base station apparatus through the antenna 201 as a transmission signal.

The base station apparatus shown in FIG. 4 receives
5 the signal transmitted from the communication terminal apparatus with the plural antennas 101. At this time, the signal is received in the reception directivity formed by the directivity control section 102. The received signal is processed by a prescribed radio reception
10 processing and becomes a baseband signal. The directivity control section 102 is a processing section for giving a weighting coefficient to each antenna to form the directivity thereof. The directivity control section 102 controls the reception directivity to be used
15 at the time of reception and the transmission directivity to be used at the time of transmission.

On the other hand, the channel estimation is performed by estimating the impulse response using adaptive algorithm 103. That is, the tap coefficient is
20 set by means of the zero forcing (ZF) algorithm, the least mean square (LMS) algorithm, the recursive least square (RLS) algorithm, or other algorithm on the basis of a received signal. The tap coefficient is successively updated in conformity with these pieces of algorithm. The
25 set of these estimated tap coefficients is transmitted to the replica generation section 104 and the frame formation section 108 as channel estimation information.

The replica generation section 104 obtains a candidate wave form (or a replica) by making the data pattern of the signal transmitted from the communication terminal apparatus pass through a filter on an estimated
5 propagation path having the tap coefficient set by the adaptive algorithm 103. The replica is formed about all of the considerable data patterns.

The replica is compared with the data pattern of the signal transmitted from the communication terminal
10 apparatus and the result of the comparison is transmitted to the judgment section 105. The judgment section 5 selects a replica being most approximate to the data pattern, and judges the data pattern corresponding to the replica to be the data pattern of the signal transmitted
15 from the communication terminal apparatus to transmit the data pattern to the error detection section 106. The error detection section 106 performs the error detection processing of the judged data. Reception data are thereby
obtained.

20 Incidentally, in the maximum likelihood sequence estimation, the optimum data pattern may efficiently be searched by means of the Viterbi algorithm.

In the base station apparatus, data to be transmitted are transmitted to the frame formation section 108 after
25 the data is digitally modulated in the modulation section 107. In the frame formation section 108, the data to be transmitted and the tap coefficient set by the adaptive

algorithm 103 are configured into frame configurations. The data to be transmitted and the tap coefficient that have been configured to be the frame configurations are transmitted from the antennas 101 in the directivity
5 formed by the directivity control section 102 after the prescribed radio transmission processing has been performed.

The signal transmitted from the base station apparatus is received by the antenna 201 of the
10 communication terminal apparatus, and then the received signal is processed in conformity with the prescribed radio reception processing to be transmitted to the detection section 202. The detection section 202 demodulates the received data in conformity with the
15 orthogonal detection or other demodulation methods. In this case, because the received data includes an information symbol and the tap coefficient information set by the base station apparatus, the symbol is transmitted to the equalization section 203 and the tap
20 coefficient information is used as the initial value of the adaptive algorithm 204.

In the adaptive algorithm 204, generally, an initial value (main tap being one, and the others being zero) is first set for setting a tap coefficient, and the processing
25 of updating a tap gain is performed after that. However, in the present embodiment, the tap coefficients are calculated by the adaptive algorithm in the base station

apparatus is used as the initial value. Consequently, the coefficient can be set only by performing the processing of updating the tap gain. That is, the processing of updating the tap gain is performed from a level equal to the level at which the tap coefficient update processing has been performed to raise the estimation accuracy thereof to a considerable extent by means of the tap coefficient. As a result, the calculation up to the initial value setting in the adaptive algorithm can be omitted, and the load of the calculation of the equalization processing in the communication terminal apparatus can be decreased. Moreover, because the processing time can be shortened up to the initial value setting in the adaptive algorithm, the processing time of the equalization processing in the communication terminal apparatus can be shortened.

To put it concretely, in FIG. 6, generally, when the communication terminal apparatus performs the equalization processing, the channel estimation processing is begun from the point "A" in FIG. 6. In the present embodiment, the channel estimation processing is begun from the point "B" in FIG. 6. In such a way, in the present embodiment, the channel estimation processing is performed after the tap coefficient update processing by which the estimation accuracy is raised up to a considerable level has been performed.

The tap coefficient set by the adaptive algorithm

204 is transmitted to the equalization section 203. The equalization section 203 forms an equalization filter by the use of the input tap coefficient, and the equalization section 203 performs the equalization processing of the information symbol (the reception data) after detection by means of the equalization filter.

The reception data processed in conformity with the equalization processing in this way is transmitted to the error detection section 205. In the error detection section 205, the error detection processing, e.g. cyclic redundancy check (CRC), of the judged data is performed. Reception data is thus obtained.

As described above, in the communication terminal apparatus according to the preset embodiment, because a tap coefficients are calculated by the adaptive algorithm in the base station apparatus is used as an initial value for omitting the processing up to the initial value setting in the adaptive algorithm in the communication terminal apparatus, the load of the calculation in the equalization processing in the communication terminal apparatus can be decreased, and the processing time of the equalization processing can be shortened.

Moreover, because the base station apparatus does not perform the pre-coding in the relation with the communication terminal apparatus, the load of the processing in the base station apparatus can be decreased.

In the case where the communication between the base

station apparatus and the communication terminal apparatus in the radio communication method in the present embodiment is asymmetrical communication, the transmission and the reception of a short known signal is periodically performed between the base station apparatus and the communication terminal apparatus, and the tap coefficient set by the adaptive algorithm is periodically transmitted to the communication terminal apparatus from the base station apparatus as the channel estimation information. Consequently, even if the forward link is long owing to the asymmetrical communication, the communication terminal apparatus can perform the equalization processing of the reception data by the use of the tap coefficient transmitted periodically from the base station apparatus. Consequently, the equalization processing becomes possible to follow the propagation environment during the long forward links, and the deterioration of the performance of communication can be prevented.

The present invention is not limited to the aforesaid embodiment, but the invention can be implemented in various alterations. For example, although, in the aforesaid embodiment, the case where the communication system is the TDD system is described, the present invention can be applied to all of the systems in which the transmission and the reception are performed by the use of the same frequency like the code division duplex

(CDM).

The communication terminal apparatus of the invention adopts the configuration comprising the reception section for receiving a reception signal including channel estimation information, and an equalization processing section for performing the equalization processing of the reception signal in conformity with the adaptive algorithm by the use of the channel estimation information.

10 According to the configuration, because the processing up to the initial value setting in the adaptive algorithm in the communication terminal apparatus by the use of the tap coefficient set by the adaptive algorithm in the base station as the initial value, the load of the calculation of the equalization processing in the communication terminal apparatus can be decreased, and the processing time of the equalization processing can be shortened.

Incidentally, here, the initial value setting in the communication terminal apparatus is to set the channel estimation information transmitted from the base station apparatus as the tap coefficient that the communication terminal apparatus estimated by improving the accuracy of the channel estimation information up to a certain extent estimation accuracy by means of the adaptive algorithm.

The base station apparatus of the present invention

is a base station apparatus for performing the radio communication with the communication terminal apparatus having the aforesaid configuration, and the base station apparatus adopts the configuration comprising a channel estimation section for performing the channel estimation on the basis of the reception signal by the use of the adaptive algorithm, and a transmission section for transmitting a signal including the channel estimation information obtained by channel estimation means.

10 According to the configuration, the pre-coding is not performed in the relation with the communication terminal apparatus. Consequently, the load of the processing at the base station apparatus can be decreased.

15 The radio communication method of the invention obtains channel estimation information by performing channel estimation on the basis of a reception signal and transmits the signal including the channel estimation information to a communication terminal apparatus on the base station apparatus side, and performs the equalization processing of the signal transmitted from the base station apparatus in conformity with the adaptive algorithm by the use of the channel estimation information included in the signal transmitted from the base station apparatus on the communication terminal apparatus side.

25 According to the method, because the processing up to the initial value setting in the adaptive algorithm in the communication terminal apparatus by means of the

tap coefficient set by the adaptive algorithm as the initial value in the base station apparatus, the load of the calculation of the equalization processing in the communication terminal apparatus can be decreased, and
5 the processing time of the equalization processing can be shortened.

In the radio communication method of the invention, the communication between the base station apparatus and the communication terminal apparatus is asymmetrical
10 communication, and the base station periodically transmits channel estimation information to the communication terminal apparatus.

According to the method, even if the forward link is long owing to the asymmetrical communication, the
15 communication terminal apparatus can perform the equalization processing of reception data by the use of the tap coefficients transmitted periodically from the base station apparatus. Consequently, the equalization processing becomes possible to follow the propagation
20 environment during the long forward link, and it is possible to prevent the deterioration of the performance of the communication.

As described above, according to the present invention, because the processing up to the initial value
25 setting in the adaptive algorithm in the communication terminal apparatus is omitted by the use of the tap coefficient set by the adaptive algorithm in the base

station apparatus as the initial value, the load of the calculation in the equalization processing in the communication terminal apparatus can be decreased, and the processing time of the equalization processing can
5 be shortened.

This application is based on the Japanese Patent Application No. HEI 11-276131 filed on September 29, 1999, entire content of which is expressly incorporated by
10 reference herein.

Industrial Applicability

The present invention can be applied to a base station apparatus and a communication terminal apparatus
15 in a digital radio communication system.

CLAIMS

1. A communication terminal apparatus comprising:
reception means for receiving a plurality of
reception signal including channel estimation

5 information; and

equalization processing means for performing
equalization processing of the reception signal in
conformity with adaptive algorithm by means of the channel
estimation information.

10 2. A base station apparatus for performing radio
communication with said communication terminal apparatus
according to claim 1, said base station apparatus
comprising:

channel estimation means for performing channel
15 estimation on a basis of a reception signal by means of
the adaptive algorithm; and

transmission means for transmitting a signal
including channel estimation information obtained by said
channel estimation means.

20 3. A radio communication method, comprising the
steps of:

obtaining channel estimation information by
performing channel estimation on a basis of a reception
signal;

25 transmitting a signal including the channel
estimation information to a communication terminal
apparatus, on a base station apparatus side; and

performing equalization processing of the signal transmitted from said base station apparatus in conformity with adaptive algorithm by means of the channel estimation information included in the signal transmitted from said base station apparatus, on a communication terminal apparatus side.

4. The radio communication method according to claim 3, wherein communication between said base station apparatus and said communication terminal apparatus is asymmetrical communication, and the channel estimation information is periodically transmitted from said base station apparatus to said communication terminal apparatus.

ABSTRACT

The processing up to initial value setting in adaptive algorithm in a communication terminal apparatus is omitted by the use of a tap coefficient set by the adaptive algorithm in a base station as an initial value, and thereby the load of the calculation of equalization processing in the communication terminal apparatus is decreased, and the processing time of the equalization processing is shortened.

1/3

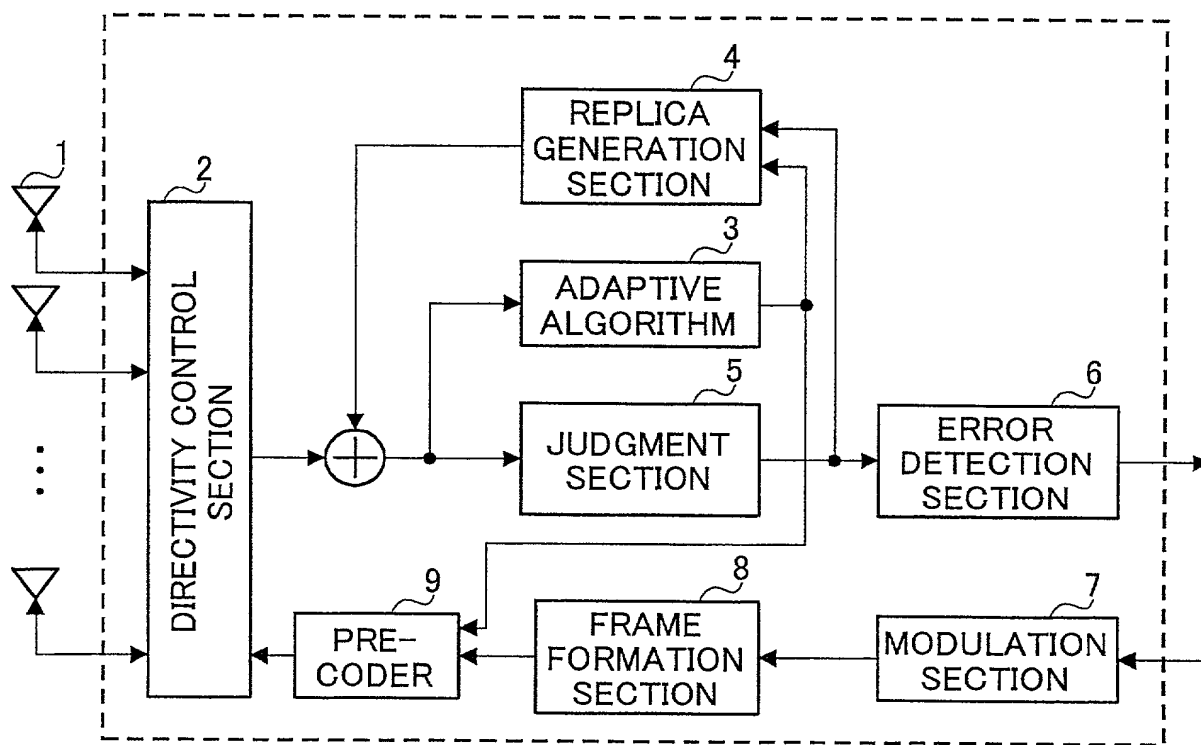


FIG. 1

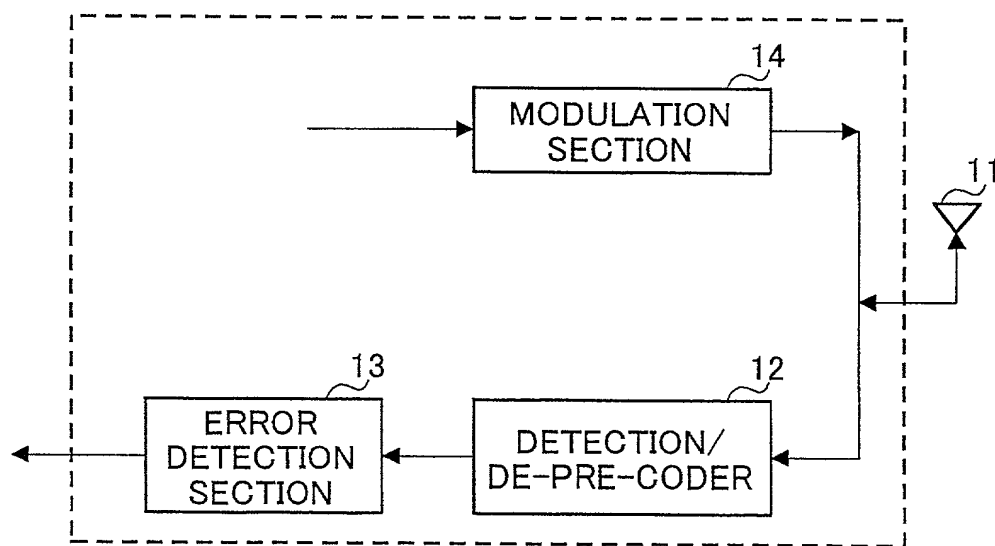


FIG. 2

2/3

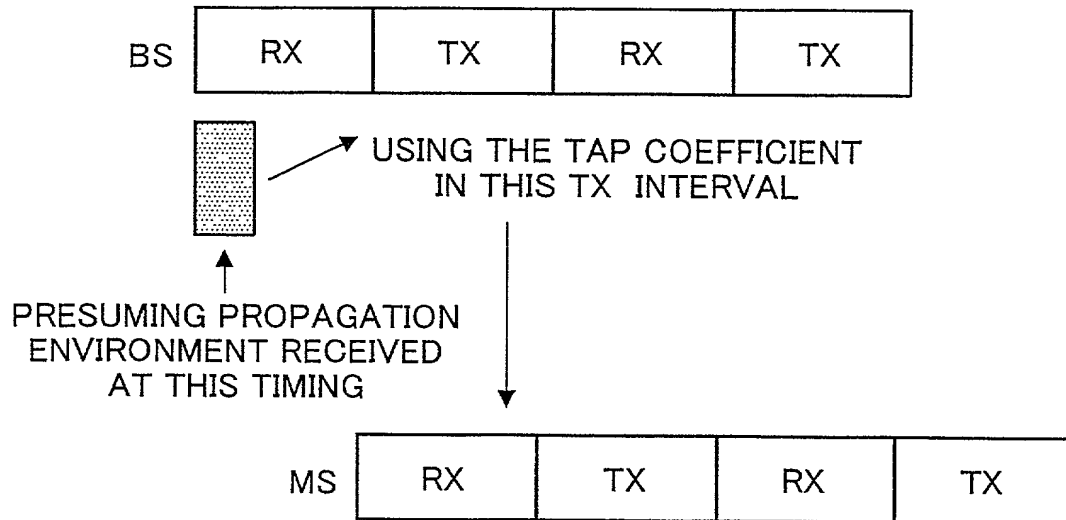


FIG.3

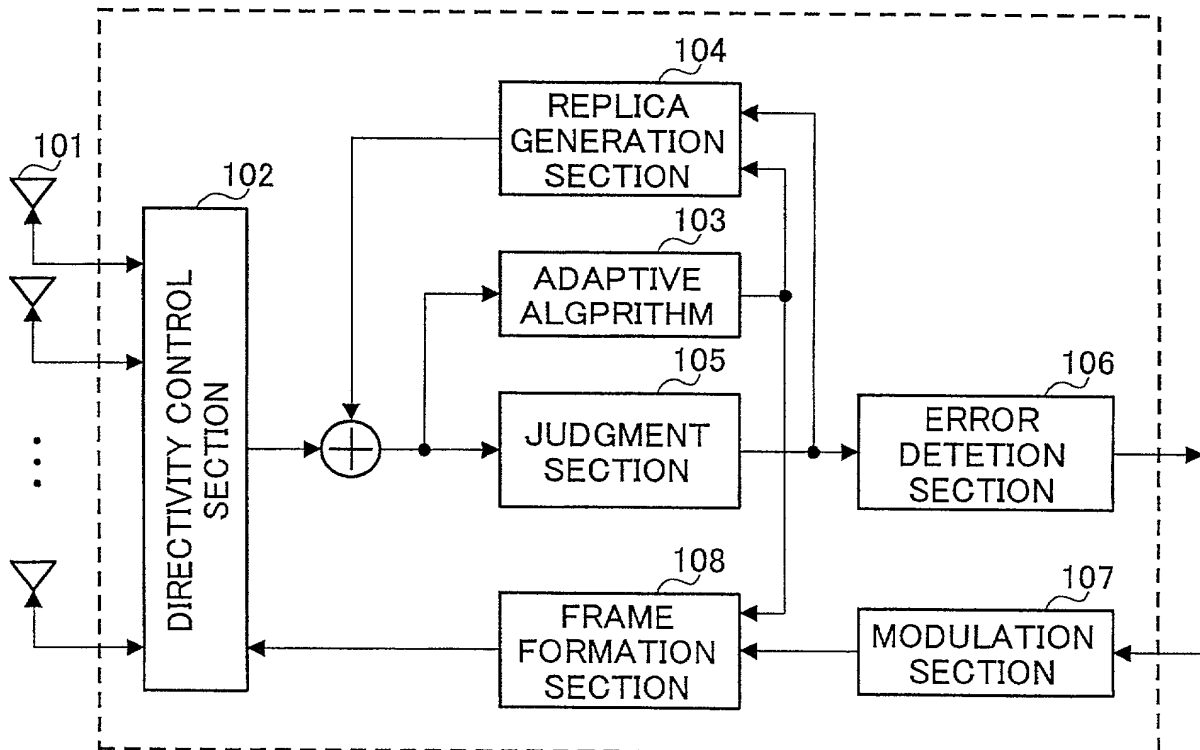


FIG.4

3/3

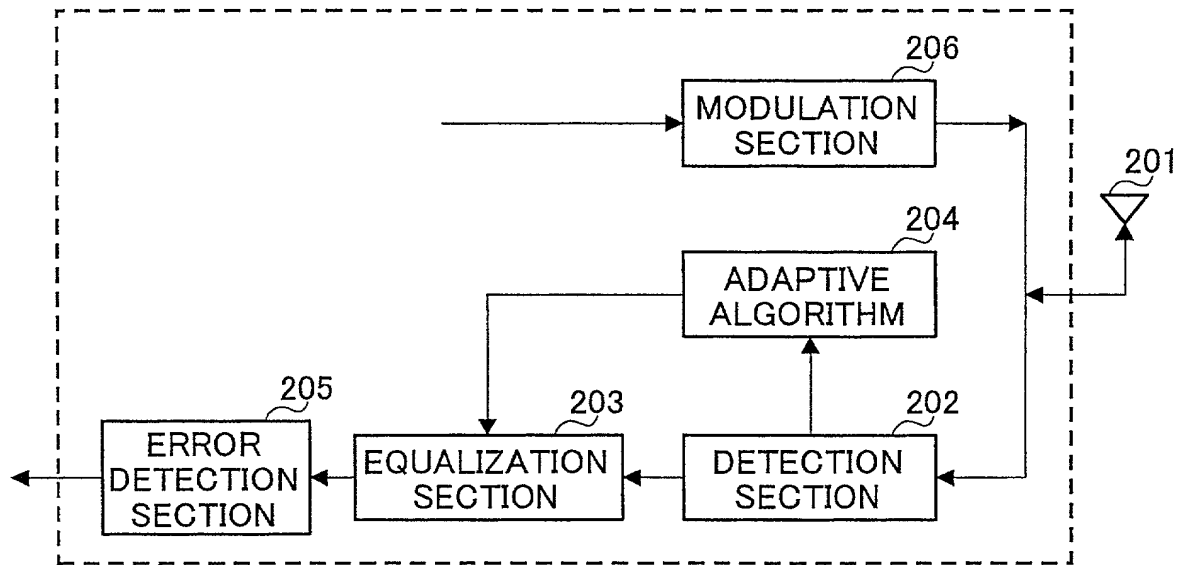


FIG. 5

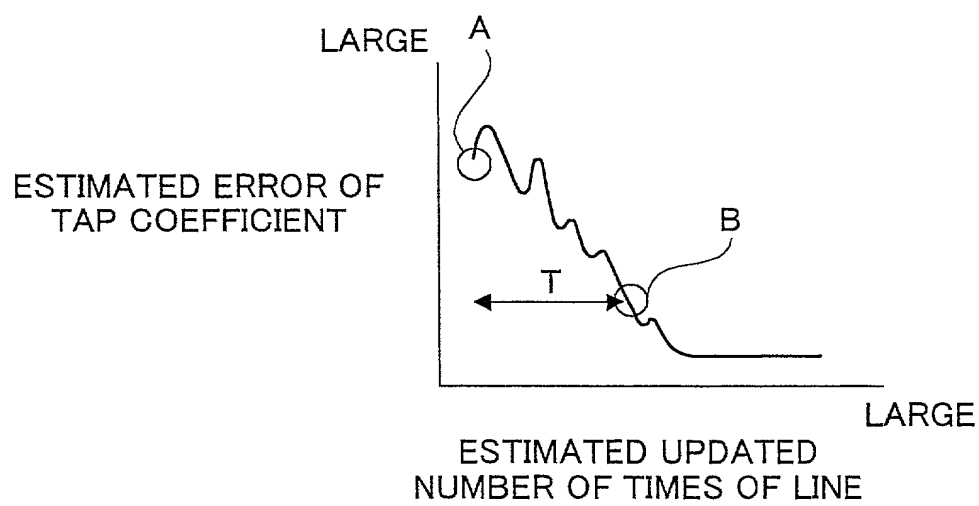


FIG. 6

APPLICATION FOR UNITED STATES PATENT
Declaration for Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on

the invention entitled: COMMUNICATION TERMINAL APPARATUS AND RADIO COMMUNICATION METHOD

the specification of which 2 (file no _____)

(check at least one) 3 ☒ is attached hereto
4 ☐ was filed on _____ as (5) U.S. Application Serial No. _____
6 ☐ and was amended _____
(if applicable)

7 ☒ was filed as PCT international application
Use this portion only if you are entering the U.S. National phase based on a PCT International Application designating the U.S.
8 Number PCT/JP00/05804
9 on August 29, 2000
and was amended under PCT Article(s) 19 and/or 34
10 on _____ (if applicable).
11 priority date claimed in PCT International Application
JAPAN JP11-276131 29/September/1999
(Country) (Number) (Day/Month/Year Filed)
(Country) (Number) (Day/Month/Year Filed)
(Country) (Number) (Day/Month/Year Filed)

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended, by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date earlier than that of the application(s) on which priority is claimed.

Prior (Foreign) Application(s) any Priority Claims Under 35 U.S.C. 119			Priority Claimed	
(Country)	(Number)	(Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Country)	(Number)	(Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Priority Claim(s) from U.S. Provisional Application(s) – I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

12b Application No.	Day/Month/Year Filed	Application No.	Day/Month/Year Filed
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Do not use this portion to identify a PCT application if the parent application is the U.S. National phase of the PCT application	I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between filing date of the prior application and the national or PCT international filing date of this application.		
	13 (U.S. Application Number)	(U.S. Filing Date)	Status (patented, pending, abandoned)

I hereby appoint the following attorneys of the firm of Stevens, Davis, Miller & Mosher, L.L.P. as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office:

James E. Ledbetter, Reg. No. 28732; Thomas P. Pavelko, Reg. No. 31689; and Anthony P. Venturino, Reg. No. 31674.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO
STEVENS, DAVIS, MILLER & MOSHER, L.L.P., 1615 L Street, N.W., Suite 850, Washington, D.C. 20036,
TELEPHONE (202) 408-5100, FACSIMILE (202) 408-5200.

See page 2 for signature lines

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

PAGE 2 OF U.S.A. DECLARATION FORM

14a	Typewritten Full Name of Sole or First Inventor	<u>Yoshiko</u>	<u></u>	<u>SAITO</u>
		Given Name	Middle Name	Family Name
15a	Inventor's Signature	<u>Yoshiko</u>	<u></u>	<u>Saito</u>
16a	Date of Signature	<u>February</u>	<u>14</u>	<u>2001</u>
		Month	Day	Year
17a	Residence	<u>Yokosuka-shi</u>	<u>Kanagawa</u>	<u>JAPAN</u>
		City	State or Province	Country
18a	Citizenship	<u>JAPAN</u>		
19a	Post Office Address (Insert complete mailing address, including country)	<u>4-3-20-301, Ikeda-cho, Yokosuka-shi,</u> <u>Kanagawa 239-0806 JAPAN</u>		
14b	Typewritten Full Name of Sole or First Inventor	<u>Mitsuru</u>	<u></u>	<u>UESUGI</u>
		Given Name	Middle Name	Family Name
15b	Inventor's Signature	<u>Mitsuru</u>	<u></u>	<u>Uesugi</u>
16b	Date of Signature	<u>February</u>	<u>14</u>	<u>2001</u>
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17b	Residence	<u>Yokosuka-shi</u>	<u>Kanagawa</u>	<u>JAPAN</u>
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14c	Typewritten Full Name of Sole or First Inventor	<u>Osamu</u>	<u></u>	<u>KATO</u>
		Given Name	Middle Name	Family Name
15c	Inventor's Signature	<u>Osamu</u>	<u></u>	<u>Kato</u>
16c	Date of Signature	<u>February</u>	<u>14</u>	<u>2001</u>
		Month	Day	Year
17c	Residence	<u>Yokosuka-shi</u>	<u>Kanagawa</u>	<u>JAPAN</u>
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14d	Typewritten Full Name of Sole or First Inventor	<u></u>	<u></u>	<u></u>
		Given Name	Middle Name	Family Name
15d	Inventor's Signature	<u></u>	<u></u>	<u></u>
16d	Date of Signature	<u></u>	<u></u>	<u></u>
		Month	Day	Year
17d	Residence	<u></u>	<u></u>	<u></u>
		City	State or Province	Country
18d	Citizenship	<u></u>		
19d	Post Office Address (Insert complete mailing address, including country)	<u></u>		

*Note to Inventor: Please sign name on line 15 exactly as it appears in line 14 and insert the actual date of signing on line 16. If there are more than four inventors, please add a copy of this page for identification and signatures for the additional inventors.